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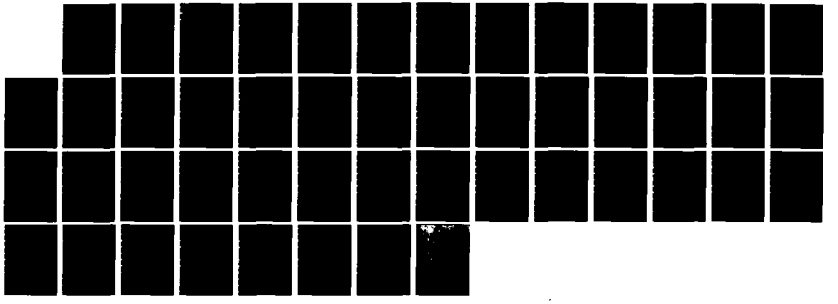

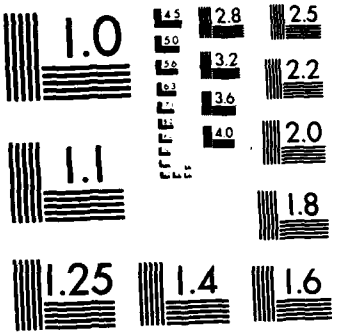

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# DEPUTY FOR ENGINEERING FACILITY ALTERNATIVES

April 1983

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## EXECUTIVE SUMMARY

The existing facilities used by Deputy for Engineering (EN) have serious deficiencies which impede his ability to meet mission requirements. The dispersion of EN facilities is the most serious problem. It not only reduces the productivity of EN personnel, but limits the critical tasks of systems integration engineering.

Correction of the deficiencies requires construction of a consolidated facility to house all EN personnel and equipment. The most cost-effective option is to construct a 190,000 square foot addition to Building 485. At a cost of about $18 million (in FY85 dollars) this facility would provide for consolidation of all EN functions and offer enhanced mission capability for systems integration testing and evaluation.

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# 1. INTRODUCTION

The Deputy for Engineering (EN), Aeronautical Systems Division (ASD), provides system engineering, technical direction and engineering management support to Systems Program Offices (SPOs) and other ASD organizations at Wright-Patterson Air Force Base (WPAFB). EN presently comprises 62 organizational units with an authorized strength of 1,618 military and civilian personnel. Roughly 48 percent of the EN personnel are assigned to the various SPOs for specific projects.

The remaining personnel, designated as "home office", provide development and test support in avionics, flight systems, and equipment engineering. The home office staff is specifically tasked with systems integration responsibility to facilitate the transition of technology from the laboratory to the field.

EN home office personnel currently occupy portions of 12 different buildings at Area B, WPAFB. The Deputy for Engineering has been concerned that the dispersion and fragmentation of his organization is impeding mission accomplishment. Logistics Management Institute (LMI) was tasked to conduct a three-phase study of EN facilities. In the Phase 1 report (Task AF202), Assessment of Existing Deputy for Engineering Facilities, September 1982, LMI identified major facilities deficiencies within EN and addressed the impact of those deficiencies on mission accomplishment. The Phase 1 findings are listed below:

- Dynamic and changing mission requirements within EN require flexibility in facility requirements and accommodation of unique equipment. New mission requirements, growth, and the subsequent reorganization of EN will require additional space and better quality facilities than presently exist.

- Interdirectorate technical information transfer and innovation are fundamental to the success of EN's mission. Presently their loss or degradation is significant and due almost entirely to the dispersion of EN facilities.

- Dispersion of organizations within EN and within the directorates creates costs in time lost in personnel traveling, in management control, and other communication-related problems.

- The condition and layout of several facilities is inadequate for the mission to be performed and for the expensive equipment housed in them.

- The floor space in several facilities is not adequate for the engineering evaluation functions occurring within those spaces.

- The potential for avoiding unnecessary costs in SPO-related work with properly designed EN facilities and engineering equipment is high. Avoidance of just a few multi-million dollar contractor change proposals would more than pay for the additional cost of eliminating existing facilities deficiencies.

In summary, LMI concluded that existing EN facilities deficiencies impede the ability to meet current mission requirements and will have a greater negative impact as EN mission requirements grow.

Phase 2 of the study, which this report covers, provides a description of current and projected facility requirements, identifies feasible alternatives to reduce or eliminate the impact of facilities deficiencies on mission performance, and compares the various alternatives on a total cost basis. Phase 3 of the study is intended to provide a cost-benefit analysis of the alternatives.

This report on facilities alternatives is divided into three major sections: enumeration of the facility requirements; discussion of possible solutions to alleviate the facilities deficiencies; and evaluation of selected alternatives.

## 2. FACILITY REQUIREMENTS

The three major categories which must be considered in determining facility requirements are facility condition, facility dispersion and space allocation.

### FACILITY CONDITION AND SERVICEABILITY

The inadequacies of the current facilities with regard to condition and serviceability suggest several factors which should be considered in determining serviceability requirements. Important among these are age, layout and construction.

The age and condition of a building can present serious facility problems. The majority of the current EN buildings are 30 to 40 years old and were originally constructed as hangars and warehouses. Although these buildings have been remodeled and repaired, they are not really adequate. For example, lack of adequate power sources and poor environmental controls in Buildings 28, 125 and 156 have hampered equipment operations for several of the EN organizations. In at least one case, the building condition renders it totally unsuitable for its current use. Building 156, which presently houses simulators and associated computer equipment has been classified by the Base Civil Engineer as suitable for "forced use" only. Most of the other buildings are classified usable, however they require substantial maintenance and repair efforts to keep them in that status, due to their age and the need for replacement or repair of major components.[1]

Because these buildings were originally designed for other purposes the layout and construction in some buildings also cause problems. In these cases

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[1]Dell'Isola, Alphonse J. and Stephen J. Kirk, Life Cycle Cost Data, McGraw-Hill, NY 1983.

the available space cannot be fully utilized because the floor area has been fragmented in an effort to provide adequate office space. Special purpose spaces such as high-bay and equipment spaces are currently being used for administrative purposes because of poor or unsuitable building layout. In spite of alterations and modifications, hangars and warehouses do not easily lend themselves to research and development work.

These current facilities problems indicate that the mission of EN could be better supported by more modern buildings, specifically designed for engineering purposes. These buildings need reliable power and air-conditioning systems to support the engineering work. The structures should be sound and the floor layout should be conducive to full and efficient utilization of the building.

FACILITY DISPERSION AND LOCATION

The current dispersion of EN facilities has caused serious organizational fragmentation at both the directorate and divisional levels. This fragmentation adversely affects communication, control, technology transfer, productivity and morale. These problems have adversely impacted EN mission capability. A major function of EN is integration of all aircraft functions. Yet this mission is almost impossible to achieve in a situation where personnel from various branches cannot communicate easily and freely. In many cases, equipment should be jointly tested and evaluated, but because of the lack of a common test facility the various branches are often forced to conduct their tests separately.

The seriousness of these problems indicate that maximum consolidation should be a strong point in consideration of the mission requirements. The facility or facilities selected should be centrally located to allow for easy communication and large enough to allow for at least directorate-level integrity. There is a real need for consideration of a centralized systems

engineering and test facility to support the development and evaluation mission of EN. This capability will fulfill a long-standing Headquarters, U.S. Air Force (HQ USAF) and Air Force Systems Command (AFSC) requirement to provide for effective use of systems integration and simulation in weapons system development.[2] To be effective, the test facility must be located close to other EN functions to provide all organizations easy access.

## SPACE REQUIREMENTS

The most obvious concern in the consideration of facility requirements is the amount of square footage needed to adequately house the functions. Air Force standards can be used to determine the square footage needed for many categories of facilities. We used this method for determining the amount of administrative space required. Table 2-1 shows the administrative space requirements for each major directorate, based on the projected population and the current standard for administrative facilities, as taken from Air Force Manual 86-2, Chapter 13. In each case, the net square footage (SF) requirements have been adjusted by a growth factor and a loss factor to determine gross square footages required. The growth factor allows for changes in personnel strength and mission requirements between now and 1986. The loss factor covers the amount of space lost in a building because of interior walls, entry ways, corridors, etc. Additional square footage for common use spaces such as conference rooms, store rooms, etc., have also been added.

There are no standards for special purpose areas such as equipment space, computer space, etc. Requirements are established on a case-by-case basis. For this study each branch was asked to review requirements for equipment space and determine the amount of square footage needed. Requirements for

[2]See HQ USAF message 192015Z JUN 80 and HQ AFSC message 021945Z SEP 80.

TABLE 2-1. ADMINISTRATIVE AND SUPPORT SPACE REQUIREMENTS

| CURRENT FACILITIES | | | | PROJECTED REQUIREMENTS | |
|---|---|---|---|---|---|
| DIRECTORATE | POP. | SF (NET) | NET SF REQUIRED PER AF STANDARD | POP. | NET SF REQUIRED PER AF STANDARD |
| ENA | 304 | 42,675 | 39,520 | 371 | 48,320 |
| ENE | 246 | 27,682 | 31,980 | 268[a] | 34,840 |
| ENF | 275 | 34,942 | 35,750 | 336 | 43,680 |
| ENS | 68 | 5,138 | 4,940 | 77 | 10,010 |
| EN/ENO[b] | | | | | - 0 -[b] |
| TOTAL (NET) | 893 | 116,437 | 116,090 | 1,052 | 131,260 |
| TOTAL REQ'D. GROSS | | | | | 164,075 |

[a]Some branches currently within ENE are scheduled for transfer to ENS; these changes are reflected in the Population Projections.

[b]EN/ENO will remain in the ASD Headquarters Complex at Building 14; therefore space requirements for EN/ENO are not considered in future projections.

computer space were determined by the EN Computer Activities Group. Table 2-2 shows the square footage requirements for special purpose space by directorate. As in Table 2-1 the net square footages have been adjusted by a loss factor to determine gross square footage requirements.

The major portion of the special purpose space is required to support the development, testing, and evaluation missions of EN. High-bay space will be used as the core of a centralized systems engineering and test facility. The facility will contain multiple cockpits, visual scenes, radar and infrared sensors and mission scenarios to support real-time, man-in-the-loop simulation and testing. The special purpose work areas will be used by the EN organizations to develop and evaluate specific weapon system components.

TABLE 2-2. SPECIAL PURPOSE SPACE REQUIREMENTS

| CURRENT FACILITIES | | | PROJECTED REQUIREMENTS | | |
|---|---|---|---|---|---|
| DIRECTORATE | NET SF HIGH BAY | NET SF WORK SPACE | NET SF HIGH BAY | NET SF WORK AREA | NET SF COMPUTER AREA |
| ENA | 5,507 | 19,033 | 625 | 27,293 | 5,450 |
| ENE | 9,472 | 3,272 | 10,500 | 15,228 | 5,450 |
| ENF | - 0 - | 1,895 | - 0 - | 1,895 | 5,450 |
| ENS | - 0 - | 220 | - 0 - | 300 | 2,650 |
| TOTAL (NET) | 14,979 | 24,420 | 11,125 | 44,716 | 19,000 |
| TOTAL REQ'D. GROSS | | | 11,125[a] | 50,800 | 27,000[b] |

[a]Gross SF for High-Bay Area is virtually the same as the Net Figure due to the open-bay design.

[b]The Gross SF for Computer Space includes a 6,000 SF central classified computer room which will be used by all directorates.

# 3. FACILITY ALTERNATIVES

Several different approaches could be taken in an effort to alleviate the current EN facilities deficiencies. These options must be evaluated against the requirements in order to develop feasible alternatives for comparison.

## FACILITY OPTIONS

A variety of facility options are available to EN. After examination of the current situation at WPAFB, the following options were chosen as worthy of further consideration:

1. Remain in the present facilities, make improvements to facilities and install communication links to alleviate current problems.
2. Partially consolidate EN functions, perhaps on a directorate level, using available Area "B" assets.
3. Totally consolidate EN functions through new construction or expansion of an existing facility.
4. Relocate EN functions to a different facility either in Area "B" or elsewhere.

### Improvements to Present Facilities

Option 1 is not a status-quo solution. Repairs, improvements and modifications to some of the facilities would correct deficiencies and increase serviceability. New communications and transportation systems could be introduced to mitigate the problems caused by dispersion. Organizational realignments could be made to increase management control and diminish the fragmentation within the EN organizations.

These actions would have significant cost, in terms of both dollars and disruption. Although the real dollar costs are probably much lower than any of the other options, the benefits are correspondingly limited. Because of the age, condition, construction and layout of most of the facilities,

improvements and modifications would have a limited and transitory effect. Most of these facilities have undergone numerous such repairs and changes over the years, and yet they still have notable limitations. New communication systems and organizational changes might improve dialogue and interaction within EN, but they would not address the real problem, the need of the various EN organizations to be able to work together in a systematic and integrated manner to fully perform their mission. Since this option does not provide the needed consolidation of EN organizations, it was not considered further.

Partial Consolidation

Option 2 calls for consolidation of EN components at some level below total consolidation. It has several possibilities, such as consolidating at the division or directorate levels or perhaps even grouping two or more of the directorates together. This approach has some advantages in that it lends itself to a cluster approach to consolidation and would allow opportunity for total consolidation at a later date.

EN has been trying to achieve partial consolidation for several years, without success. The two main hindrances have been lack of adequate facilities and the constantly changing program requirements within ASD. No buildings are currently available within EN which can fully house even one of the directorates. The only way to find adequate space would be to move some other ASD organization out of a facility; this would cause a ripple effect throughout ASD. With the ever-changing program and mission requirements of ASD and EN the situation never stays static long enough to allow the proposed chain of moves to take place. When a new SPO comes into existence, someone has to make room -- which sets everything back in motion again. In the words of one EN supervisor, this "hopscotch approach" has not and will not work.

Additionally, a partial consolidation still would not allow for the coordinated effort required to perform the systems integration mission so critical for today's modern weapons systems. For these reasons, partial consolidation was also eliminated as a viable alternative.

Total Consolidation

Total consolidation, Option 3, is the most desirable solution because it would totally eliminate current problems and give EN the facilities they need to adequately perform their mission. This could be accomplished by either a new facility or modifying an existing facility. Construction of a new facility is the most costly option. A quick estimate places the cost of a totally new facility in the neighborhood of $30 million, based on total square footage requirements and current Air Force pricing guidance. Recognizing that a project in this cost range would be very hard to fund, we also examined existing facilities within Area B that could be expanded to meet the total EN consolidation requirement. Discussions were held with ASD and the Air Force Wright Aeronautical Laboratories (AFWAL), to determine what facilities might be available. After field surveys of several buildings, three facilities, Buildings 485, 254, and 22, were selected for further consideration.

Relocation

Relocation, Option 4, actually came into consideration during investigation of the partial consolidation option. In efforts to find a facility to house one or more of the EN directorates within Area B, it became apparent that no suitable facility was available there. Relocation of EN to facilities outside Area B and even outside WPAFB was then considered. The 2750th Air Base Wing was contacted about available space in Areas A and C. No suitable facility is available in Area A, and only one large facility is becoming available in Area C; it is already programmed for another use. In

fact, the 2750th is also looking for space in Area B, which will put greater constraints on the available space there.

Since no suitable facility was available at WPAFB we then began to consider other Air Force sites. Several Air Force bases have test and simulation facilities similar to the facilities required by EN. However, discussions with personnel at these bases indicated that the facilities were fully utilized and, in most cases, they were not completely compatible with the missions and functions of EN. Serious objections were also raised, justifiably so, about moving anywhere away from the SPOs. The primary mission of EN is to provide systems engineering and technical support to the SPOs and to help move new technology from the laboratory to the field. It would be difficult, if not impossible, to provide this service when physically removed from both the SPOs and the ASD laboratory facilities at WPAFB. The option was judged unacceptable.

## COMPARISON OF FEASIBLE ALTERNATIVES

Consideration of all options makes it clear that the only feasible and desirable option for eliminating EN facility deficiencies is total consolidation.

Four alternatives for total consolidation are:

- Build a completely new facility
- Expand Building 22
- Expand Building 254
- Expand Building 485.

Each alternative is discussed below in terms of square footage requirements and corresponding costs. In addition to construction costs, associated costs, such as demolition and modification, have been included where applicable to give a total cost picture. Other factors such as suitability and relocation requirements are discussed where they appear to be significant.

New Construction

A totally new facility would require construction of a 253,000 SF building including administrative, computer, equipment and high-bay space. This alternative is without question the most desirable since a new facility could be designed and tailored to the exact needs of EN. Undoubtedly this alternative is also the most expensive. Table 3-1 shows the construction costs for a complete new facility.

TABLE 3-1. COSTS FOR CONSTRUCTION OF A NEW CONSOLIDATED FACILITY

| TYPE OF SPACE | REQUIREMENT (GROSS SF) | RATE ($/SF) | COST ($) |
|---|---|---|---|
| Admin | 164,000 | 70 | 11.48M |
| High Bay | 11,125 | 130 | 1.44M |
| Work | 50,800 | 96 | 4.87M |
| Computer | 27,000 | 178 | 4.81M |
| Total | 252,925 | 118.50(Avg) | 22.60M[a] |

[a]Does not include site work and utility cost required for a new facility. These costs normally add 15 - 20 percent to the cost of a project. This would place total project cost in the neighborhood of $30 million.

It should be noted that these costs are for construction of the building only and do not include the site development and utility costs which would be expected for a new facility.

Building 22

Building 22 was originally built in 1942 as an Armaments Laboratory. The main structure is a 46,000 SF high-bay hangar. Two two-story administrative wings totaling 138,000 SF have been added. The building is currently used jointly by several different AFWAL and ASD organizations. The high-bay area has been partitioned into offices and work spaces.

The main advantage of Building 22 is that it provides ample, in fact, excess, high-bay space for EN requirements. This excess could be used for administrative purposes; however, additional computer space, administrative space and work space would still be needed. Table 3-2 gives the requirements and costs for the required additions and modifications to Building 22.

TABLE 3-2. COSTS FOR EXPANSION OF BUILDING 22

| TYPE OF SPACE | REQUIRED (GROSS SF) | AVAILABLE | SHORTAGE | COST ($) |
|---|---|---|---|---|
| Admin | 164,000 | 138,000 | 26,000 | 1.82M |
| High Bay | 11,125 | 46,000 | (34,875)[a] | -0- |
| Work | 50,800 | 34,875[a] | 15,925 | 1.52M |
| Computer | 27,000 | -0- | 27,000 | 4.81M |
| Total Construction Cost | | | | 8.15M |
| Associated Costs: Demolition, Repair, Modification, etc.[b] | | | | 6.76 |
| Total Project Cost | | | | 14.91M |

[a]Excess High-Bay Area to be converted to Work Space.

[b]Repair and modification costs do not include major electrical/mechanical repairs or component replacements.

It should be noted that major renovation costs would be incurred to modify Building 22 for EN use. The costs shown in Table 3-1 are basic modification costs for new partitions, lighting, etc., and do not include the cost of major electrical and mechanical improvements normally expected to bring a building of this age up to current standards.[1]

[1]Dell'Isola, op cit.

Building 254

This 28 year old structure is presently used by AFWAL, but will be available sometime in the near future. It is a concrete structure with a 26,000 SF high-bay test area and a two-story 10,000 SF administrative wing.

The high-bay area is more than adequate for EN's needs and would provide some excess space for conversion to a developmental work area. Substantial amounts of administrative, computer, and work spaces would have to be constructed. Table 3-3 shows the requirements and costs for converting Building 254 to a consolidated EN facility. Costs listed include a major demolition cost for removing large amounts of piping and mechanical equipment currently located in the high-bay area. Some modification costs would also be incurred in converting the excess high-bay space to work space. Additional site work would be required to provide adequate parking for an expanded facility. Some electrical and mechanical improvements could be required.

TABLE 3-3. COSTS FOR EXPANSION OF BUILDING 254

| TYPE OF SPACE | REQUIRED (GROSS SF) | AVAILABLE | SHORTAGE | COST ($) |
|---|---|---|---|---|
| Admin | 164,000 | 10,000 | 154,000 | 10.78M |
| High Bay | 11,125 | 26,000 | (7,875)[a] | -0- |
| Work | 50,800 | 7,875[a] | 62,325 | 3.44M |
| Computer | 27,000 | -0- | 27,000 | 4.81M |
| Total Construction Cost | | | | 19.03M |
| Associated Costs: Demolition, Repair, Modification | | | | 1.12 .58M |
| Total Project Cost | | | | 20.15M |

[a]Excess High-Bay Area to be converted to Work Space.

Building 485

Building 485 was built 12 years ago as an avionics test facility, which is still its primary use. It currently houses a large portion of ENA. The building has a 7,500 SF high-bay area, surrounded on three sides by approximately 55,000 SF of administrative and work space.

In order to use Building 485 as a consolidated EN facility the high-bay area would have to be expanded and additional administrative, computer, and work space would be required. Table 3-4 shows these requirements and associated costs. Expansion of Building 485 would require those functions currently housed in the high-bay area to be relocated during construction. However, this short term disturbance is not considered important in view of the many positive features of consolidating in Building 485.

TABLE 3-4. COSTS FOR EXPANSION OF BUILDING 485

| TYPE OF SPACE | REQUIRED (GROSS SF) | AVAILABLE | SHORTAGE | COST ($) |
|---|---|---|---|---|
| Admin | 164,000 | 43,300 | 121,700 | 8.52M |
| High Bay | 11,125 | 8,000 | 10,125 | .41M |
| Work | 50,800 | 13,200 | 57,000 | 3.61M |
| Computer | 27,000 | -0- | 27,000 | 4.81M |
| Totals | 252,925 | 64,500 | 189,425 | 17.35M |

# 4. CONCLUSIONS

A thorough review of EN facilities requirements and possible alternatives reveals four likely alternatives for full consolidation of EN functions:

1. Build a new facility.
2. Expand and renovate Building 22.
3. Expand Building 254.
4. Expand Building 485.

The first alternative is the most desirable, because it could be tailored precisely to EN's current requirements. However, it is also the most expensive. Total project cost would be well in excess of $30 million, a figure that would be difficult to justify when other less expensive and suitable alternatives are available. The three other alternatives utilize existing buildings which must be modified and expanded to house the consolidated EN functions. However, Building 22 is a least desirable option, partly because of the unknown cost of electrical and mechanical repairs. The age of the building is also a negative factor. The building is already 40 years old and, even with major renovations, the expected life could be extended only for 20 years. At that time new construction would require another major expenditure. Table 4-1 shows the cost of consolidation for each building compared with its expected useful life. In these terms Building 22 is shown to be the most expensive alternative. Also, before work could begin on any renovation work in Building 22, space would have to be found for several hundred present occupants. This would not be an easy task in the overcrowded and constantly changing conditions at Area B; it would also involve additional costs for the relocations.

TABLE 4-1. COST SUMMARY OF ALTERNATIVES VS. EXPECTED LIFE

| FACILITY | YEAR CONSTRUCTED | PROPOSED COST | EXPECTED LIFE | COST/YR ($) |
|---|---|---|---|---|
| New | —— | $30M | 50 | 0.60M |
| Bldg. 22 | 1942 | $14.91M | 20 | 0.75M |
| Bldg. 254 | 1956 | $20.15M | 30 | 0.67M |
| Bldg. 485 | 1972 | $17.35M | 40 | 0.43M |

The last two alternatives are equally feasible, and either solution would meet all requirements and alleviate the current facilities deficiencies. The Building 485 option has certain advantages, in addition to its lower total cost. This building already belongs to EN, which precludes moving other organizations or waiting for a building to become available. It is a modern building, specifically designed for the purpose of avionics testing and evaluation. Because the building is new it has an extended useful life, which is a long-term cost avoidance. The location and construction of Building 485 favor expansion and modification and provide flexibility for later growth. Expansion of Building 485, on the basis of construction costs and satisfaction of EN requirements, is the preferred alternative.

In support of this choice, Appendix A presents a draft Project Description Summary for a proposed expansion of Building 485. A detailed justification write-up including cost-benefit analysis and program impact will be required for this project. Appendix B presents a checklist of items which should be covered in the justification package.

APPENDIX A

PROJECT DESCRIPTION SUMMARY FOR
EXPANSION OF BUILDING 485 TO A
CONSOLIDATED EN FACILITY

APPENDIX A

PROJECT DESCRIPTION SUMMARY

FOR EXPANSION OF BUILDING 485

TO A CONSOLIDATED EN FACILITY

1. WORK TO BE ACCOMPLISHED:

A. SCOPE - Construction of a facility to house all ASD engineering functions, including 122,000 SF of administrative space, 38,000 SF developmental work space, 27,000 SF of computer space and 3,125 SF of high-bay equipment space, in order to provide a properly sized and configured facility for the Deputy of Engineering (EN). The facility will provide adequate space to house all home office personnel and all test and simulation equipment necessary for accomplishment of the EN mission. The Deputy of Engineering is the organization within ASD responsible for the transitioning of technology from the laboratories to new weapons systems. It is the key organization in developing the technical framework and following through to insure technical performance and reliability of the new aircraft. As aircraft subsystems become more highly integrated through micro-electronics, there is an evolving need for more emphasis on systems integration engineering, and more direct interaction among engineers. EN currently has 40 branch offices spread across 12 buildings. Test facilities, developmental work areas and computer facilities are also scattered, making the necessary integration a difficult, if not impossible, task. In bringing all EN functions under one roof and providing a central Systems Engineering and Integration Center, the proposed facility will allow full integration of weapons systems and result in lower cost and shorter acquisition times for new aircraft.

B. PROJECT CONSTRUCTION COST WILL NOT EXCEED $20,000,000

C. WORK DEFINITION -

(1) Work to be done - construct an addition to Building 485 to adequately house all functions of the Deputy for Engineering (EN), Aeronautical Systems Division (ASD).

(2) Physical features of the facility.

(a) Building 485 will be used as a core for an expanded facility to house all EN personnel and activities. Additions to both the high-bay and administrative areas will be required.

(b) The main feature of the consolidated facility will be a Systems Engineering and Integration Center housing five simulators and associated computer hardware. Hot-bench work areas adjacent to the simulators will be provided to enhance development and testing. The major portion of this area (11,125 SF) will be high-bay space with a clearance of 30 feet.

(c) Administrative space and developmental work areas will be located around the main integration and test area. Approximately 122,000 SF of administrative space and 38,000 SF of work space will be added to Building 485 to allow for consolidation of all EN functions into one building. New construction should interface comfortably with the existing building in both utility and appearance. Exhibit I provides a listing by branch and type of the space required.

(d) The facility will also include a 27,000 SF central computer center for EN. Data links will be provided to work stations within the branches and directorates. A Class "A" vault, approximately 7,500 SF, will be provided for classified processing equipment. This area must be fully shielded and isolated. The remaining 19,500 SF

area will require limited security measures. The entire area will follow typical design standards with regard to raised deck flooring, temperature and humidity control, fire protection, and filtered power. The facility will be connected to the base computer center by means of protected lines. Connections to other ASD and AFWAL components may also be required for certain branches.

2. FUNCTIONS OF THE FACILITY AND OCCUPANTS

A. The consolidated facility is intended to support systems engineering, integration and test of weapon and avionics subsystems and to facilitate transition of technology from the laboratory to the field. The proposed project will bring together all EN components to allow a total systems engineering and integration approach to weapons systems development and testing. The facility will allow for fully integrated testing of proposed avionics, weapons, and aircraft performance using realistic cockpits, visual scenes, sensors, and mission scenarios. The facility will provide the complete capability for testing both hardware and software. Hot-bench capability, in conjunction with simulation, will allow enhancement of development testing. Mission capabilities and effectiveness will be evaluated to quantify the relative value of proposed systems in order to obtain maximum benefit for dollars expended. The capability to vary system parameters will also provide useful data in establishing new weapons systems requirements.

B. The functions to be housed in the facility include the four engineering directorates and their missions, shown below.

(1) ENA: Directorate of Avionics Engineering; provides engineering management to program offices to design, develop, integrate, test, and acquire airborne weapons systems. Identifies current/future avionics technology needs, supports research and development to satisfy needs.

Applies current technology through interfaces with laboratories, government agencies, universities, and industry. Areas of responsibility include weapons delivery, reconnaissance, fire control, navigation, missile simulation, communications, electronic warfare, and information processing.

(2) ENE: Directorate of Equipment Engineering; provides equipment system engineering, technical direction and engineering management to program offices. Identifies current/future equipment technology needs and supports research and development to satisfy those needs. Applies current technology through interface with laboratories, government agencies, universities and industry. Areas of responsibility include crew equipment and human factors, support equipment, engineering specialties and simulations.

(3) ENF: Directorate of Flight Systems Engineering; provides technical direction and engineering management to program offices and general flight systems engineering support to the Aeronautical Systems Division. Identifies current/future flight systems technology needs and supports research and development to satisfy those needs. Applies current technology through interfaces with laboratories, government agencies, universities, and industry. Areas of responsibility include flight technology, structures, propulsion and flight equipment.

(4) ENS: Directorate of Systems Engineering; provides the leadership for systems engineering, technical direction, and engineering management support to program offices. Ensures that program directors are provided with engineering visibility and technical alternatives and risks related to engineering decisions and that program directors have all possible engineering guidance in making program decisions. Provides multi-directorate engineers to integrate related technical parameters and assure

compatibility of all physical, functional and program interfaces in a manner which optimizes the total system capability. Areas of responsibility include system definition, reliability, maintainability, performance, safety, survivability and vulnerability.

An organizational chart showing the relationship of the directorates and their various branches is included as Exhibit II A. A brief functional or operational description for each branch requiring special purpose space is provided in Exhibit II B. Requirements for branches not listed are primarily administrative space.

3. OCCUPANTS AND VISITORS

The total number of permanant occupants projected to 1987, will be 1,052, with approximately 30 percent females. These personnel are primarily EN home office technicians. There will be an additional transitory requirement for 50-100 personnel. These personnel will be mainly contractor personnel or personnel temporarily assigned from other Air Force organizations.

4. HOURS OF OPERATION

It is anticipated that the facility will be used primarily during the normal eight-hour day shift, five days per week throughout the year. Because of "flexitime", the building will normally be occupied from 0700 to 1700 with 30 percent occupancy at 0700 and 1700. It may be necessary for some test or computer work to run past normal working hours.

5. FUTURE EXPANSIONS

While no future expansions are currently planned, the possibility of expansions or modifications should be considered. Due to the uncertainty inherent in research and development work, flexibility must be maintained within the basic facility. Specifically, the high-bay area should not be totally enclosed by administrative/work space. Also interior walls should be

non-load-bearing to allow for easy relocation. Utility and service connections should also provide for future expansions and modifications.

6. SECURITY REQUIREMENTS

The major security feature of the facility will be protection for the data links to, from, and within building. Some of the equipment areas will require physical security in certain controlled areas. A major security area will be the classified computer processing center.

7. PARKING SUPPORT

Adequate parking is available on the abandoned runway/apron area. A loading dock and apron will be added as part of the new construction.

8. BENEFICIAL OCCUPANCY

This project is to be submitted in the FY86 Military Construction Program to provide beneficial occupancy in late FY87 or early FY88.

9. SPECIAL REQUIREMENTS

Because of the particular nature of the work involved, most of the branches have specialized requirements for equipment, power, and other support services. These special requirements include such things as hot and cold water, compressed air, vacuum, eyewash stations, showers, exhaust hoods, wood and metal shops, photo lab and dark room, overhead hoists, antenna towers, etc. All work areas will require temperature and humidity control, smoke detection and fire-fighting systems, and filtered power. The majority of these spaces will also require protected internal and external data links. Exhibit III gives a detailed listing by branch of all special requirements.

10. DRAWINGS AND FLOOR PLANS

Attached sketches (Exhibit IV) are provided to illustrate functional and space relationships only and are not to be construed as fixed layouts. An architectural design effort is required to provide a complete and satisfactory

design solution. (For example, either single- or two-story space may be used.) The sketches provided, together with the descriptions of function/ organization listed in Exhibit II, define the relationships between the various EN components. The final design must integrate individual requirements and functional interrelationships. Directorate and branch integrity should be maintained as well as possible. It may be necessary to separate developmental work areas from office environments, but the functions should remain conveniently close for communication and interaction.

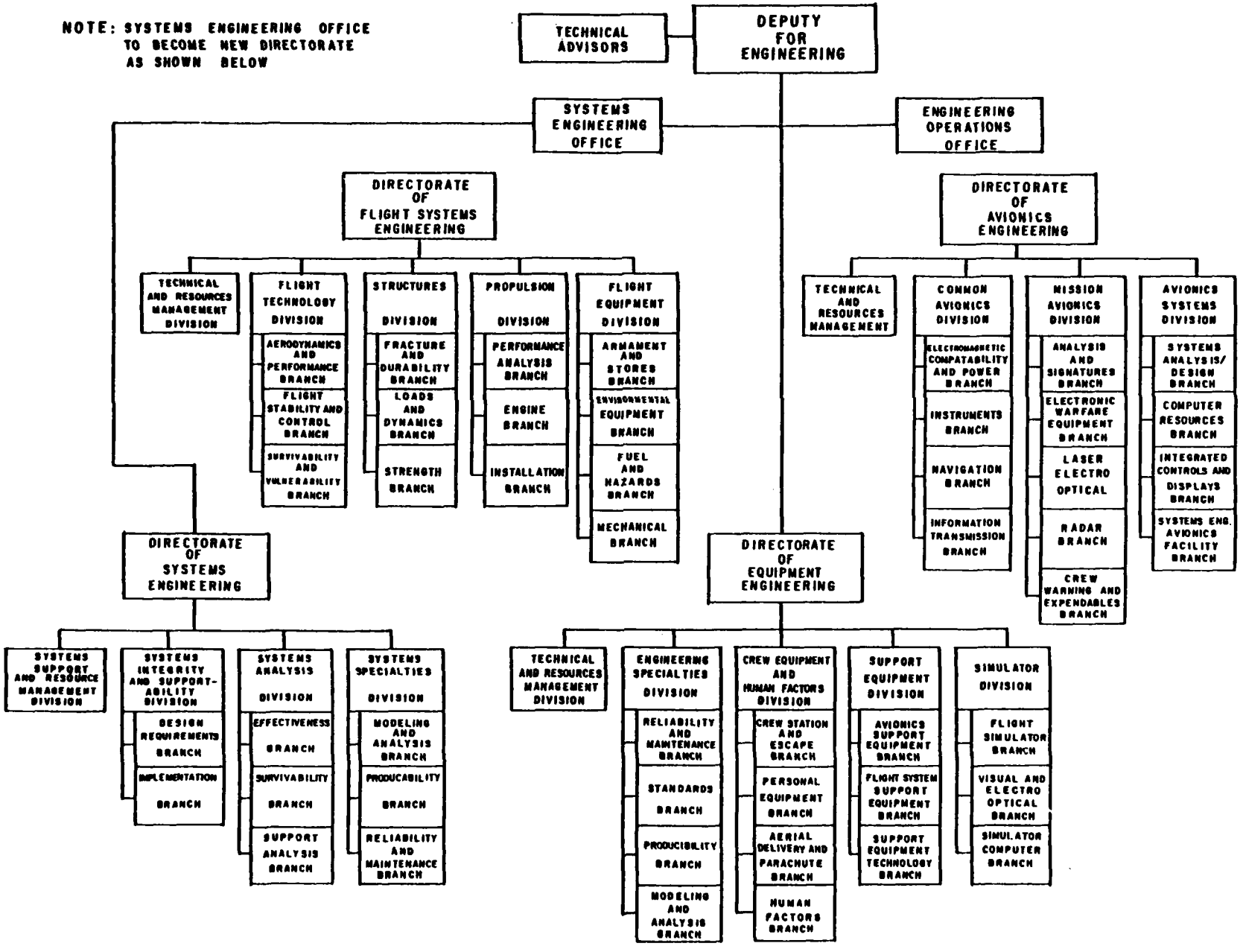
# EXHIBIT I: SPACE REQUIREMENTS BY DIRECTORATE & BRANCH

| BRANCH | CURRENT PERSONNEL | OFFICE & SUPPORT SPACE | | | SPECIAL PURPOSE SPACE | | | |
|---|---|---|---|---|---|---|---|---|
| | | AF STANDARD | CONFERENCE ROOM | MISC.[1] | HIGH BAY | WORK AREA | COMPUTER | TOTALS |
| ENA | 7 | 910 | 491 | | | 594 | | |
| ENAC | 4 | 520 | 228 | 140 | | | | |
| ENACE | 25 | 3,250 | | | 625 | 5,175 | | |
| ENACI | 16 | 2,080 | | | | 700 | | |
| ENACN | 16 | 2,080 | | | | | | |
| ENACT | 21 | 2,730 | | | | 4,400 | | |
| ENAM | 5 | 650 | 315 | 119 | | 2,500 | | |
| ENAMA | 28 | 3,640 | | 216 | | 350 | | |
| ENAME | 10 | 1,300 | | 100 | | 3,300 | | |
| ENAML | 24 | 3,120 | | 146 | | 250 | | |
| ENAMR | 14 | 1,820 | | 100 | | 2,000 | | |
| ENAMW | 18 | 2,340 | | 141 | | | | |
| ENAS | 4 | 520 | 234 | | | 800 | | |
| ENASA | 25 | 3,250 | | | | | | |
| ENASC | 18 | 2,340 | | | | | | |
| ENASF | 35 | 4,550 | | 70 | | 6,000 | | |
| ENASI | 12 | 1,560 | | | | 1,000 | | |
| ENAZ | 22 | 2,860 | 1,292 | | | 224 | | |
| | 304 | 39,520 | 2,560 | 1,032 | 625 | 27,293 | 5,450 | 76,480 |
| ENE | 5 | 650 | | | | | | |
| ENEC | 4 | 520 | | | | | | |
| ENECA | 12 | 1,560 | | 170 | | | | |
| ENECC | 11 | 1,430 | | | | | | |
| ENECE | 9 | 1,170 | | | 1,000 | 2,000 | | |
| ENECH | 14 | 1,820 | 384 | 264 | 8,500 | 4,600 | | |
| ENEG | 4 | 520 | | | | | | |
| ENEGA | 13 | 1,690 | | | | 1,500 | | |
| ENEGF | 19 | 2,470 | | | | | | |
| ENEGT | 10 | 1,300 | | | | | | |
| ENES | 3 | 390 | | | | | | |
| ENESA | 11 | 1,430 | | | | | | |
| ENESP | 11 | 1,430 | | | | | | |
| ENESR | 9 | 1,170 | | | | | | |
| ENESS | 40 | 5,200 | | | | 2,000 | | |
| ENETV | 20 | 2,600 | | 1,500 | 1,000 | 3,650 | | |
| ENETS | 16 | 2,080 | | | | 1,000 | | |
| ENETC | 14 | 1,820 | 120 | | | | | |
| ENET | 2 | 260 | | | | | | |
| ENEZ | 19 | 2,470 | | | | 478 | | |
| | 246 | 31,980 | 504 | 1,934 | 10,500 | 15,228 | 5,450 | 65,596 |
| ENF | 9 | 1,170 | 1,420 | | | | | |
| ENFE | 6 | 780 | | | | | | |
| ENFEA | 4 | 520 | | | | | | |
| ENFEE | 9 | 1,170 | | 40 | | | | |
| ENFEF | 12 | 1,560 | | | | | | |
| ENFEM | 14 | 1,820 | | | | | | |
| ENFS | 6 | 780 | 120 | | | | | |
| ENFSF | 15 | 1,950 | | | | | | |
| ENFSL | 20 | 2,600 | | | | | | |
| ENFSS | 24 | 3,120 | | | | 287 | | |
| ENFT | 3 | 390 | 160 | | | | | |
| ENFTA | 26 | 3,380 | | | | 18 | | |
| ENFTC | 22 | 2,860 | | | | | | |
| ENFTV | 29 | 3,770 | 220 | | | 315 | | |
| ENFP | 4 | 520 | | | | | | |
| ENFPA | 18 | 2,340 | | | | 50 | | |
| ENFPE | 12 | 1,560 | | | | | | |
| ENFPI | 6 | 780 | | | | | | |
| ENFZ | 36 | 4,680 | | 96 | | 1,225 | | |
| | 275 | 35,750 | 1,920 | 136 | | 1,895 | 5,450 | 45,151 |
| ENS | 4 | 520 | | | | | | |
| ENSA | 14 | 1,820 | | 150 | | | | |
| ENSG | 20 | 2,600 | | 170 | | | | |
| ENSSA | 30 | 3,900 | | | | 300 | | |
| | 68 | 8,840 | | 320 | | 300 | 2,650 | 12,110 |
| TOTAL REQUIRED NET SF | 893 | 116,090 | 4,984 | 3,422 | 11,125 | 44,716 | 19,000 | 199,337 |
| TOTAL REQUIRED GROSS SF | | ALL ADMIN & SUPPORT 164,075 | | | 11,125 | 50,800 | 27,000 | 252,925 |

[1] Miscellaneous space includes xerox rooms, storage space, etc.

# EXHIBIT II A: EN ORGANIZATIONAL STRUCTURE

NOTE: SYSTEMS ENGINEERING OFFICE TO BECOME NEW DIRECTORATE AS SHOWN BELOW



## EXHIBIT IIB: FUNCTIONAL DESCRIPTION OF DEPUTY FOR ENGINEERING (EN) ORGANIZATIONS

EN — Provides the system engineering, technical direction, and systems engineering management to ASD program offices and general engineering support to ASD and others as directed. Identifies current and future system technology needs and supports research and exploratory and advanced developments to satisfy these needs. Assures inclusion of current applicable technology into ASD systems through continuous interfacing with the Air Force laboratories, other government agencies, universities, and industry. Provides the principal scientific advisors to the commander, ASD. Serves as the ASD office of primary responsibility for all matters concerning the USAF Scientific Advisory Board and the Division Advisory Group.

ENO — Provides support/services to the Deputy for Engineering in planning, controlling and utilizing resources and ensures availability, training, and utilization of EN personnel for ASD programs. Provides engineering evaluation/integration/direction for efforts such as international standardizations, QA software, independent engineering reviews, leadership for multi-directorate efforts, and airworthiness certification of major Class II modifications. Manages collocated clerical support. Provides administrative support to EN and Directorates in functions relating to personnel, security, publications, reports, training, correspondence, manpower, and organizations.

ENS[1] — Assigns the Directors of Engineers to provide the leadership for systems engineering, technical direction, and engineering management support to ASD program offices, the Deputy for Development Planning, and the Air Vehicle Portion of Programs assigned to other AFSC divisions. Ensures that program directors are provided with engineering visibility and technical alternatives and risks related to engineering decisions and that program directors have all possible engineering guidance in making program decisions. Provides multi-directorate integration engineers.

DIRECTORATE: ENA

ENA — Directorate of Avionics Engineering provides avionics systems engineering; technical direction; engineering management to program offices to design, develop, integrate, test, and acquire airborne weapon systems. Identifies current/future avionics technology needs; supports research/exploratory and advanced development to satisfy needs. Applies current/applicable technology to systems

[1]ENS is now an engineering office but will become a separate directorate in 1983. Specific functional descriptions for the division and branches within that directorate are still evolving.

through continuous interfacing with appropriate laboratories, other government agencies, universities and industry. Areas of responsibility: weapon delivery, reconnaissance, fire control, navigation, missile simulation, communications, computer software/hardware, information processing/computer simulations, and electronic warfare.

DIVISION: ENAC

ENAC Common avionics division responsible for systems engineering, technical direction and engineering management in the areas of navigation, data communication, flight essential equipment, and electrical power; supports systems integration, interface definition, design optimization, software development, and counter-countermeasures design. Conducts studies, defines subsystem configurations, identifies current and future avionics technology needs, and supports research, exploratory and advanced developments.

ENACA Navigation branch provides systems engineering and technical direction to system program/project offices in areas of inertial and radio navigation, inertial quality heading and attitude references, position updating velocity sensing devices, software, and EC/ECCM support. Reviews operational requirements; originates specifications; evaluates proposals; conducts engineering developments/tests. Incorporates current technology into new systems with emphasis on standardization, cost, effectiveness, and low risk while meeting performance objectives. Identifies requirements for engineering, exploratory and advanced developments for future systems.

ENACC Provides systems engineering and technical direction to system program/project offices in areas of air combat identification and air traffic control, including terminal, position monitoring, instrument landing, airborne direction finding, collision avoidance, rendezvous, station keeping, crash positioning, software and ECCM support. Reviews operational requirements; originates specifications; evaluates proposals; conducts engineering developments/tests. Incorporates current technology into new systems with emphasis on standardization/cost effeciveness/low risk while meeting performance objectives. Identifies requirements for engineering, exploratory, and advanced developments for future systems.

DIVISION: ENAI

ENAI Responsible for systems engineering, technical direction and engineering management in areas of software support, computer hardware, controls and displays, and instruments. Supports directorate integration, interface and design optimization efforts, and provides systems engineering support and technical direction to system program offices. Defines subsystem configurations and identifies performance capabilities, objectives and alternate solutions based on criteria such as effectiveness, risk, and costs.

Identifies current and future avionics technology needs and supports research and advanced developments in areas of functional responsibility.

ENAIA Provides systems engineering and technical direction to system/project offices in the areas of software support tools, including specification and applications of language translators, interactive computer simulators, operating systems and development support systems. Establishes software technical policy including language control, standardization, acquisition methodology and avionics integration support facilities. Identifies requirements for engineering, exploratory and advanced developments for the future.

ENAIC Provides systems engineering and technical direction to system/project offices in the areas of avionics subsystems controls, cockpit electronic displays, video recording equipments and the information source interfaces. Identifies requirements for engineering, exploratory and advanced developments for the future.

DIVISION: ENAM

ENAM Responsible for systems engineering management in the areas of electromagnetic interface and compatibility, laser/electro-optic systems, imaging systems, and radar systems. Conducts studies, defines system configurations, and identifies performance capabilities and objectives based upon criteria such as effectiveness, risk and cost. Identifies current and future avionics technology needs and supports research, exploratory and advanced development programs. Areas of functional responsibility follow.

ENAMC Provides systems engineering and technical direction to system/project offices in the areas of photographic/electronic sensors; image and data recording; optics; image stabilization; ground-based radar signal processing; automatic target screeners; automatic change detectors; sensitized materials; and film printers and processors. Identifies requirements for engineering, exploratory and advance developments for the future.

ENAMA Provides systems engineering and technical direction to system/project offices in the areas of electromagnetic interference and compatibility (EMIC), electrical bonding and grounding and compromising emanations (TEMPEST). HQ USAF technical office of primary responsiblity for electromagnetic hazards to electro explosive devices. HQ AFSC office of primary responsibility for atmospheric electricity. Manages ASD/EN precision measurement equipment center. Identifies requirements for engineering, exploratory and advanced developments for the future.

DIVISION: ENAS

ENAS Responsible for systems engineering and technical direction in areas of avionic system architecture, interface definition, integration, design and performance analyses, and test and evaluation.

Supports the integration, interface and design optimization efforts of the directorate, including software and hardware. Conducts studies; defines subsystem configurations and identifies performance capabilities and objectives for cost, risk, and effectiveness. Incorporates current/applicable technology and identifies requirements for engineering developments to satisfy future systems.

ENASA Provides consultant services to system program/project offices during avionics system acquisition. Performs avionics systems studies and analyses to identify system configurations and performance requirements. Performs effectiveness, risks, and cost assessments on planned and existing avionics systems. Defines guidelines for avionics system design, development, test and integration. Identifies requirements to satisfy future equipment and system needs.

ENASC Conducts analyses and simulations of avionics systems to validate design parameters, establish functional feasibility, identify critical and limiting factors, and delineate needed technology/development programs. Supports system architecture, mission analyses and design tradeoff studies by defining system performance, budgeting errors, establishing functional requirements and assessing life cycle cost. These efforts are accomplished by combining avionic functions; e.g., navigation, weapon delivery, reconnaissance, or communication, with platform parameters, atmospherics, target signature, threat, etc., to determine mission effectiveness.

DIVISION: ENAZ

ENAZ Provides administrative support for director in technical and resources management division; plans, organizes and controls directorate efforts and allocates resources. Reviews technical achievements for assigned goals. Provides chief avionics engineers who, with division chiefs, organize/control directorate's engineering support to ASD programs. Provides engineering and technical direction to integrate subsystem elements and equipment into effective and timely systems. Provides technical and operational needs; handles independent research and development programs and conducts special studies; formulates policies and procedures and provides business management and administrative control of directorate activities.

DIRECTORATE: ENE

ENE Directorate of Equipment Engineering provides equipment system engineering, technical direction, and engineering management to ASD program offices and general equipment engineering in support of ASD and other organizations as directed. Identifies current and future equipment technology needs, and supports research, exploratory and advanced developments to satisfy these needs. Applies current equipment technology to ASD systems through continuous interfacing

with the appropriate AFSC laboratories, other government agencies, universities, and industry. Areas of functional responsibilities include crew equipment and human factors, simulators, ground support equipment and engineering specialties.

DIVISION: ENEC

ENEC Provides systems engineering, technical direction, and engineering management for crew equipment and human factors in the following areas: crew station and escape; human factors; personal equipment; and aerial delivery and parachutes. Supports the integration, interface, and design optimization efforts of the directorate; directs and supports engineering analysis, development and evaluation of crew equipment and human factors. Maintains state-of-the-art knowledge. Identifies current and future crew equipment and human factors technology needs. Supports research, exploratory and advanced developments to satisfy these needs.

ENECC Provides systems engineering and technical direction to systems program/project offices in areas of crew station designs, specifically instrument panel and console arrangement/geometry; controls lighting/internal and external vision, passenger and crew seating, ground escape and ditching, hatch and canopy design, and ejection and escape capsule systems. Conducts analyses and engineering evaluation. Establishes performance and functional objectives based on effectiveness, risk, and cost criteria. Identifies required computer simulations, integrates current technology into system designs, and identifies requirements for engineering and advanced exploratory developments.

ENECE Provides systems engineering and technical direction to systems program/project offices for personal equipment in areas of life support equipment such as personnel atmosphere supply equipment, floatation and survival equipment, high altitude protective assemblies, flight helmets, flashblindness protection, anti-G protection, visual distress signals, inflight feeding and sanitation. Directs and supports engineering analysis, development, and evaluation of state-of-the-art knowledge. Identifies current and future personal equipment technology needs, and supports research, exploratory and advanced development to satisfy these needs.

ENECA Provides systems engineering and technical direction to systems program/projects offices in the areas of air cargo handling, air transportability, airdrop, airborne rescue, parachutes and other aerodynamic drag devices for emergency escape, ejection seat and escape capsule stabilization and recovery, cargo extraction and recovery, missile and RPV recovery, aircraft deceleration, and nuclear weapon delivery. Accomplishes analyses, development tests, and evaluations. Identifies required computer simulations, defines alternate solutions for meeting system requirements and establishes performance objectives based on criteria such as effectiveness, risk, and cost.

ENECH Provides engineering support and technical direction to system program/project offices in the area of human factors. Identifies required level of human factors engineering effort, integrates new human factors technology in design and identifies required advanced or exploratory research. Identifies man/machine requirements for crew station and configuration, displays/controls work station layout and aircraft lighting. Serves as aeronautical systems division's focal point for human factors documentation and support. Conducts analyses and evaluations of operator and maintenance tasks to define training and training equipment by using instructional system development.

DIVISION: ENEG

ENEG Provides systems engineering, technical direction and engineering management in the areas of support equipment requirements and applications for avionic and flight systems. Supports system integration, interface and design optimization efforts. Directs analyses, engineering development, tests and evaluation of support equipment. Maintains state-of-the-art knowledge of support equipment technology. Identifies support equipment technology needs and requirements for exploratory and advanced developments to satisfy those needs.

ENEGP Provides engineering support and technical direction to system program/project offices in the areas of propulsion and power for support equipment for testing, maintenance/overhaul and ground noise suppression of aircraft propulsion systems and generation and conversion of ground mobile electrical/pneumatic power. Conducts analyses, engineering development, tests and evaluations. Defines alternate solutions for meeting system requirements and establishes performance objectives based on such criteria as effectiveness, risk and cost. Incorporates applicable current technology into assigned equipments and identifies requirements for exploratory and advanced developments to satisfy future needs.

ENEGT Provides engineering support and technical direction to system program/project offices for support equipment technology. Conducts and monitors studies and analyses on support equipment requirements and applications, cost effectiveness of support equipment alternatives, and the support system planning activities. Establishes system requirements for built-in tests and testability. Performs technical integration within the division and maintains current status activities of collocated lead support equipment engineers, serving as a repository of corporate memory in this regard.

DIVISION: ENES

ENES Provides systems engineering, technical direction and engineering management for reliability, maintainability, producibility, standards, and aircraft maintenance modeling. Supports directorate integration, interface, and design optimization efforts. Serves as ASD OPR for technical management, policy, procedures and document review for reliability, maintainability, and quality assurance, for

AFSC divisions and laboratories. Manages specifications, system criteria, and DoD, USAF, and local standardization efforts. Maintains knowledge of engineering specialties technical needs and supports research and development to satisfy them.

ENESR[2] Provides engineering support and technical direction to systems program/project offices in the reliability, environmental, and maintainability disciplines. Identifies required computer simulations. Defines alternate solutions for meeting system requirements and establishes performance and objectives based on criteria such as effectiveness, risk, and cost. Incorporates the current applicable technology into assigned systems and equipments. Identifies requirements for engineering development and exploratory and advanced developments to satisfy future equipment and system needs. Conducts analyses and evaluations of requirements in the areas of functional responsibility.

ENESS Provides technical direction and guidance to DoD, Air Force, and local engineering standardization programs in support of ASD and AFSC laboratories at WPAFB and other AFSC divisions; conducts the advanced procurement data support program; negotiates actions for transfer of Air Force engineering responsibility to AFLC; prepares and releases Air Force (Form 1) drawings for ASD; conducts the commandwide program for design handbooks published in the AFSC DH series. Develops and provides DoD control for model designation of military aircraft, rockets, and guided missiles.

ENESP[2] Provides engineering, support, technical direction to systems program/project offices in the areas of quality assurance engineering, value engineering, the parts control program, and producibility engineering. Serves as the ASD focal point for the government industry data exchange program and the product division's defective parts and components control program. Supports engineering by analysis evaluation and verification of acquisition program requirements in the indicated engineering functional areas.

ENESA[2] Provides engineering support, technical direction to systems program/project offices in the areas of simulation and analysis of aircraft maintenance models. Uses models to project manpower and support equipment requirements of new aircraft. Assesses sortie generation capabilities under various maintenance and operational concepts and evaluates support impacts of design/logistics alternatives. Maintains relevant maintenance experience data bank used to develop models. Functions as OPR for logistics composite model documentation for ASD. Identifies requirements for exploratory and advanced development of maintenance support analysis techniques and data systems.

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[2]To be transferred to new ENS directorate.

DIVISION: ENET

ENET Provides systems engineering, technical direction and engineering management in the areas of simulated aircrew and maintenance training equipment. Supports the integration, interface, and design optimization efforts of the directorate. Directs and supports engineering analysis, development, and evaluation of simulators and other training equipment. Maintains state-of-the-art knowledge of simulation technology. Identifies current and future simulation technology needs, and supports research and exploratory and advanced developments to satisfy those needs.

ENETS Provides systems engineering support and technical direction to system program offices in the areas of mission simulators and procedures trainers for training flight personnel. Maintains trainers for systems and ground equipments for training flight and ground personnel. Identifies required computer simulations. Defines alternative solutions for meeting systems requirements. Identifies requirements for engineering development and exploratory and advanced developments for future equipment and system needs. Conducts analyses, engineering development and test and evaluation.

ENETC Provides systems engineering support and technical direction to system program offices in areas of computer hardware, software, and information processing applied to training simulators and equipment, and commonality in digital approaches to sensor and visual simulation. Identifies required computer simulations, defines alternative solution for meeting systems requirements. Identifies requirements for future equipment and system needs. Conducts analyses, engineering development, and tests and evaluation.

ENETV Provides systems engineering support and technical direction to system program offices in areas of visual, electro-optical, radar, and electronic warfare training and simulation for flight personnel. Identifies required computer simulations. Defines alternative solutions for meeting systems requirements. Identifies requirements for engineering development and exploratory and advanced developments for future equipment and system needs. Conducts analyses, engineering development, and tests and evaluation.

DIVISION: ENEZ

ENEZ Provides technical and resources management. Plans, organizes, and controls directorate efforts and resources allocations; provides chief equipment engineers who, with the division chiefs, organize and control the directorate's engineering support to ASD programs. Provides equipment engineering/technical direction and engineering management to integrate subsystem elements and equipment into effective and timely systems. Provides technical planning guidance for advanced development, component improvement and independent research and development programs. Conducts special studies, formulates directorate policies and procedures, and provides business management and administration control of directorate activities.

DIRECTORATE: ENF

ENF Directorate of Flight Systems Engineering provides the technical direction and engineering management to ASD program offices, and general flight systems engineering support to ASD and other organizations as needed. Identifies current and future flight systems technology needs and supports research, exploratory and advanced developments to satisfy these needs. Applies current flight systems technology to ASD systems through continuous interfacing with the Air Force laboratories, other government agencies, universities and industry. This includes the following major technical disciplines: flight technology, structures, propulsion and flight equipment.

DIVISION: ENFE

ENFE Provides engineering support and technical direction to system program/project offices for flight equipment in the areas of armament and stores, environmental control, fuel systems and fire protection, landing gears, hydraulic systems and fasteners. Supports the integration and design optimization efforts of the directorate of flight systems engineering. Maintains state-of-the-art knowledge of flight equipment technology. Identifies current and future flight equipment technology needs and supports research, exploratory and advanced development to satisfy these needs.

DIVISION: ENFP

ENFP Provides system engineering, technical direction and engineering management in the areas of engines, propulsion performance analysis and propulsion installations. Supports the integration, interface and design optimization efforts of the directorate of flight systems engineering. Directs and supports engineering analysis, development and evaluation of aeronautical turbine engines, ramjet engines, rocket motors and related equipment, engine installation, starter and auxiliary and emergency power equipment. Maintains state-of-the-art knowledge of propulsion system technology. Establishes propulsion technology needs and supports the required research development.

DIVISION: ENFS

ENFS Provides system engineering, technical direction and engineering management in the areas of structural requirements, applications, strengths, loads, dynamics, corrosion and fracture, and durability. Directs and supports engineering integration, optimization, analysis, development, and evaluation of aeronautical engine and airframe design and equipment to ensure structural integrity of aeronautical systems. Maintains state-of-the-art knowledge of structural design technology. Identifies current and future structures technology needs and supports research, exploratory and advanced developments to satisfy these needs.

DIVISION: ENFT

ENFT Provides systems engineering, technical direction and engineering management and maintains state-of-the-art knowledge of flight technology. Supports the integration, interface, and design optimization efforts of the directorate of flight systems engineering. Directs and supports engineering analysis, development and evaluation of aerodynamic designs and hardware, internal and external aerodynamic arrangements, stability and flight controls, aerodynamic performance, and survivability/ vulnerability assessments. Identifies current and future flight technology needs and supports research, exploratory and advanced developments to satisfy these needs.

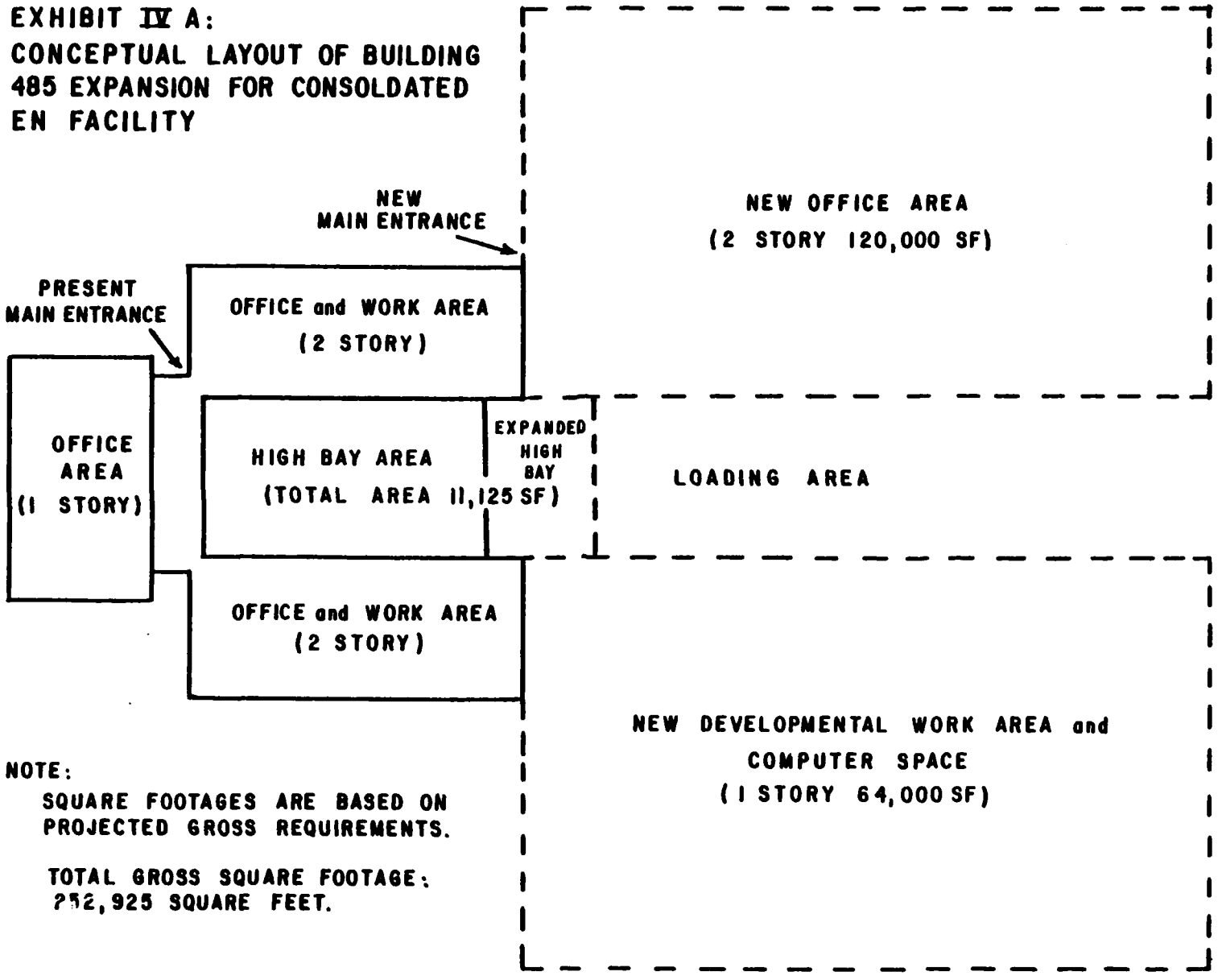
DIVISION: ENFZ

ENFZ Plans, organizes and controls directorate efforts and resources allocations. Provides chief flight systems engineers who, in conjunction with division chiefs, organize and control the directorate's engineering support. Provides the engineering, technical direction and engineering management to integrate subsystem elements and equipments into effective and timely systems. Provides guidance in technical planning for advanced development, component improvement, and independent research and development programs. Formulates directorate policies and procedures and provides business management administrative control of directorate activities.

# EXHIBIT III: SPECIAL REQUIREMENTS

| BRANCH | POWER REQUIREMENTS | OTHER SPECIAL |
|---|---|---|
| ENECA<br>ENECC<br>ENECA | | overhead crane; 12 X 12 door: compressed air; vacuum; hot & cold water and drain/ sink; emergency eyewash; exhaust hood; dark room; dressing room and shower; built-in storage lockers |
| ENECH | | shop: saws, drill press, etc. (600 SF) |
| ENEGA<br>ENEGT | 110V/60HZ/2φ/30A<br>220V/60Hz/3φ/60A<br>110V/400Hz/3φ/10A<br>110/60Hz/1φ/30A<br>28V DC/20A<br>filtered power | computer terminals; EMI protection |
| ENEGF | 115V/60Hz/1φ<br>120-208V/60Hz/3φ<br>240-416V/60Hz/3φ<br>120-208V/400Hz/3φ<br>28V DC | compressed air 10CFM @ 120 psi; 5 ton hoist |
| ENESS | filtered power | dehumidifier; hot & cold water and sink/eyewash; ADP hook-up with security |
| ENESA | 110V/20A - individual circuit for each CRT | 5 computer hook-ups; 25 data lines; Secure Area-Tempest, etc. |
| ENETS | 115V/1φ<br>220V/108V 3φ | terminal data lines |
| ENAME | 115-220V/60Hz/3φ/50A<br>115V/400Hz/3φ/50A | Data link - secure |
| ENAML | 110-220V/60Hz/3φ<br>110/400Hz/3φ<br>28V DC | Photo lab (water, exhaust, etc.; "clean area" for working on sensitive gear |
| ENACT | 28V/DC<br>115V/60Hz/1φ<br>115V/60Hz/3φ ("Y" & delta)<br>115V/400Hz/1φ<br>115V/400Hz/3φ ("Y")<br>filtered power | Antenna tower for radar dish; Secure Area |
| ENACE | 115-208/60Hz/3φ, 4 wire<br>115-208/400Hz/3φ, 4 wire<br>28 Volt DC | 2 shielded rooms/computer links; compressed air, deep sink; loading ramp, high bay door |
| ENAS<br>ENAC<br>ENAF<br>ENAI | 115-220/60Hz/3φ & 1φ<br>115-220/400Hz/3φ<br>28V DC | computer room, secure; automatic sprinkler/smoke alarms etc; temp and humidity control; power shutdown controls; perimeter security fence; storage area (computer); vacuum, compressed air; dark room (150 SF) |
| ENAMR | 120V/400Hz/3φ | |
| ENAMA | filtered 60Hz | data links; air and water cooling; security requirements; RF filter |
| ENAMW | 400HZ power | controlled access; classified storage; A/C - dehumidifier |

EXHIBIT IV A:
CONCEPTUAL LAYOUT OF BUILDING 485 EXPANSION FOR CONSOLDATED EN FACILITY

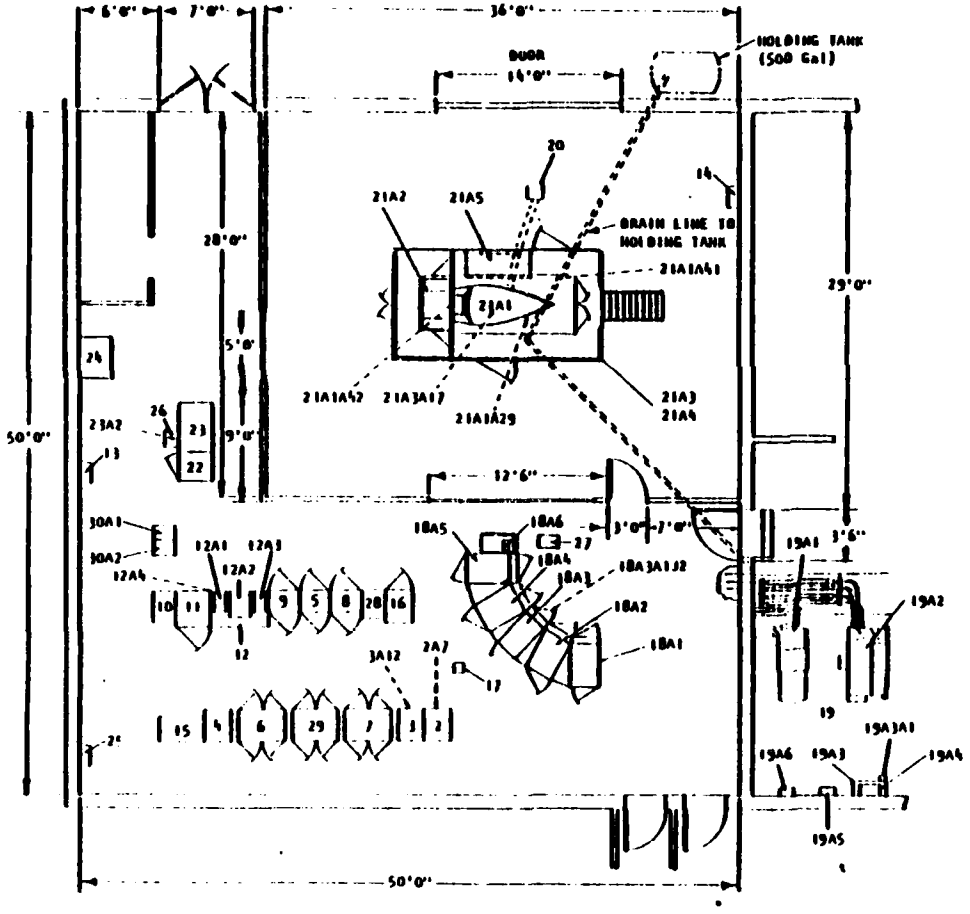



NOTE:
SQUARE FOOTAGES ARE BASED ON PROJECTED GROSS REQUIREMENTS.

TOTAL GROSS SQUARE FOOTAGE:
252,925 SQUARE FEET.

# EXHIBIT IV B: SAMPLE FLOOR PLAN FOR SINGLE STATION

Note: The sample floor plan is an A-10 Operational Flight Trainer Simulator provided by Reflectone Inc., of Tampa, Florida. The layout required for a test and evaluation simulator will vary somewhat, but required floor areas should remain about the same.




* Serial No. 62850002 only.

** Serial Nos. 62850001 and 62850002 Only.

*** As Installed On Applicable Trainers

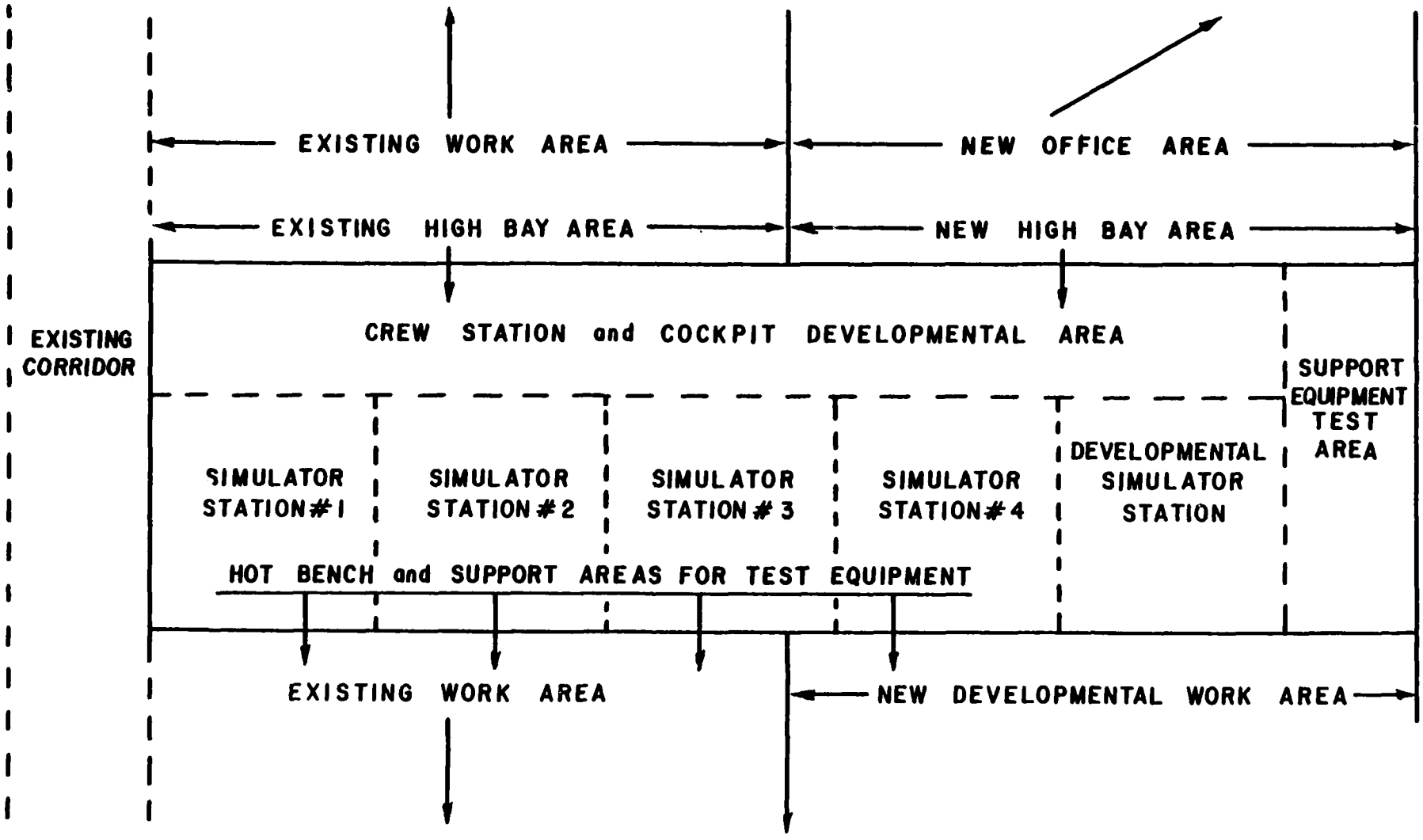
\- Indicates Not Visible From This Viewing Angle.

† Serial Nos. 62850001 and 62850002 Hazeltine Model 2000. Serial Nos. 62850003 thru 62850014 Hazeltine Model 1520.

IDENTIFICATION KEY

| UNIT NO. | |
|---|---|
| 1. | Not Used |
| 2. | Audio Cabinet |
| 2A7. | MICS Station |
| 3. | I/O Cabinet No. 1 |
| 3A12. | MICS Station |
| *4. | Magnetic Tape Unit |
| 5. | Magnetic Disc Unit No. 1 |
| 6. | EWS Computer CPU Cabinet |
| 7. | OFT Slave Computer CPU Cabinet |
| 8. | Magnetic Disc Unit No. 2 |
| 9. | Magnetic Disc Unit No. 3 |
| **10. | Cockpit Image Generator Cabinet |
| *11. | Line Printer |
| 12. | Data Terminal No. 1 (OFT) |
| 12A1. | Hard Copy Device |
| †12A2. | Operators CRT/Keyboard |
| 12A3. | Dual Magnetic Cassette |
| 12A6. | MICS Station |
| 13. | Paging Speaker |
| 14. | Paging Speaker |
| *15. | Card Reader |
| 16. | Power Distribution Cabinet |
| 17. | Instructor Overhead Light Control |
| 18. | OFT/EWS Instructor Station |
| **18A1. | Instructor Visual Display Monitor |
| 18A2. | Instructor CRT Display |
| 18A3. | Instructor Repeater Instrument Display |
| 18A3A132. | MICS Station |
| 18A4. | Instructor CRT Display |
| 18A5. | Instructor CRT Display |
| 18A6. | Hard Copy Printer |
| 19. | Hydraulic Electrical Power Room |
| 19A1. | Pneumatic Power Supply |
| 19A2. | Control Loading Hydraulic Pump |
| 19A3. | Hydraulic Power Supply Control Panel |
| 19A3A1. | Maintenance ICS Station |
| 19A4. | 400 Hz Generator |
| 19A5. | Hydraulic Unit Power Disconnects |
| 19A6. | Trainer Power Disconnects |
| 20. | Air Conditioner - Cockpit |
| 21. | Cockpit Trainee Station |
| 21A1. | Cockpit Assembly |
| 21A1A29. | MICS Station |
| 21A1A41. | MICS Station |
| 21A1A42. | MICS Station |
| **21A2. | Visual Display Unit |
| 21A3. | Base Assembly |
| 21A3A17. | MICS Station |
| 21A4. | Support Structure Assembly |
| 21A5. | On-board I/O Cabinet |
| 22. | EW Simulation Cabinet |
| ***23. | Remote EW Trainee Console |
| ***23A2. | MICS Station |
| *24. | Key Punch |
| 25. | Line Filter |
| 26. | EW Instructors Overhead Light Control |
| 27. | Digital Remote Unit (Portable Within Trainer Area) |
| †28. | Data Terminal No. 2 (EW) |
| 29. | OFT Master Computer CPU Cabinet |
| **30. | Data Terminal No. 3 (Visual) |
| 30A1. | Hard Copy Device |
| †30A2. | Operator's CRT/Keyboard |
| - | ICS and MICS Microphones and Headsets at Various Stations |

# EXHIBIT IVC:
# CONCEPTUAL LAYOUT FOR
# SYSTEMS ENGINEERING and INTEGRATION CENTER



## APPENDIX B
## MILITARY CONSTRUCTION PROJECT
## JUSTIFICATION CHECKLIST

1. What specific weapons system requires this facility?

2. What is the dollar value of the test program hardware on R&D programs that will use the facility during the first full year of operation?

3. What new technology capability does the facility provide, or does it augment present technology?

4. What economic benefits will result from this facility?

5. Why is the facility needed during the time of this MCP cycle and what would be the impact of a 1-year delay?

6. How will the facility affect subsequent RDT&E budget requests?

7. How many people are scheduled to occupy or operate the new facility?

8. Does the facility duplicate any government or commercial capability?

9. Will the facility be available for use by other agencies?

10. Is this a complete facility or a phased construction plan?

11. Was this facility requested but denied or deferred in any previous submission?

12. Will facility house new or existing equipment?

13. Are there any special construction features which a non-technical reviewer could question?

14. What is the planned disposition of the existing buildings now used for any part of this function?

15. What alternatives are there to the geographical location selected?

16. Is the activity more effectively accomplished in-house or by contract?

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Facility Alternatives, Facility Requirements, Systems Engineering and Integration Center, Consolidation, Serviceability

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Study reviews current facility deficiencies and evaluates alternatives for correcting them. Focuses on need for consolidation of EN organizations to enhance the systems integration and engineering support to ASD. Presents proposal for construction of expanded facility.

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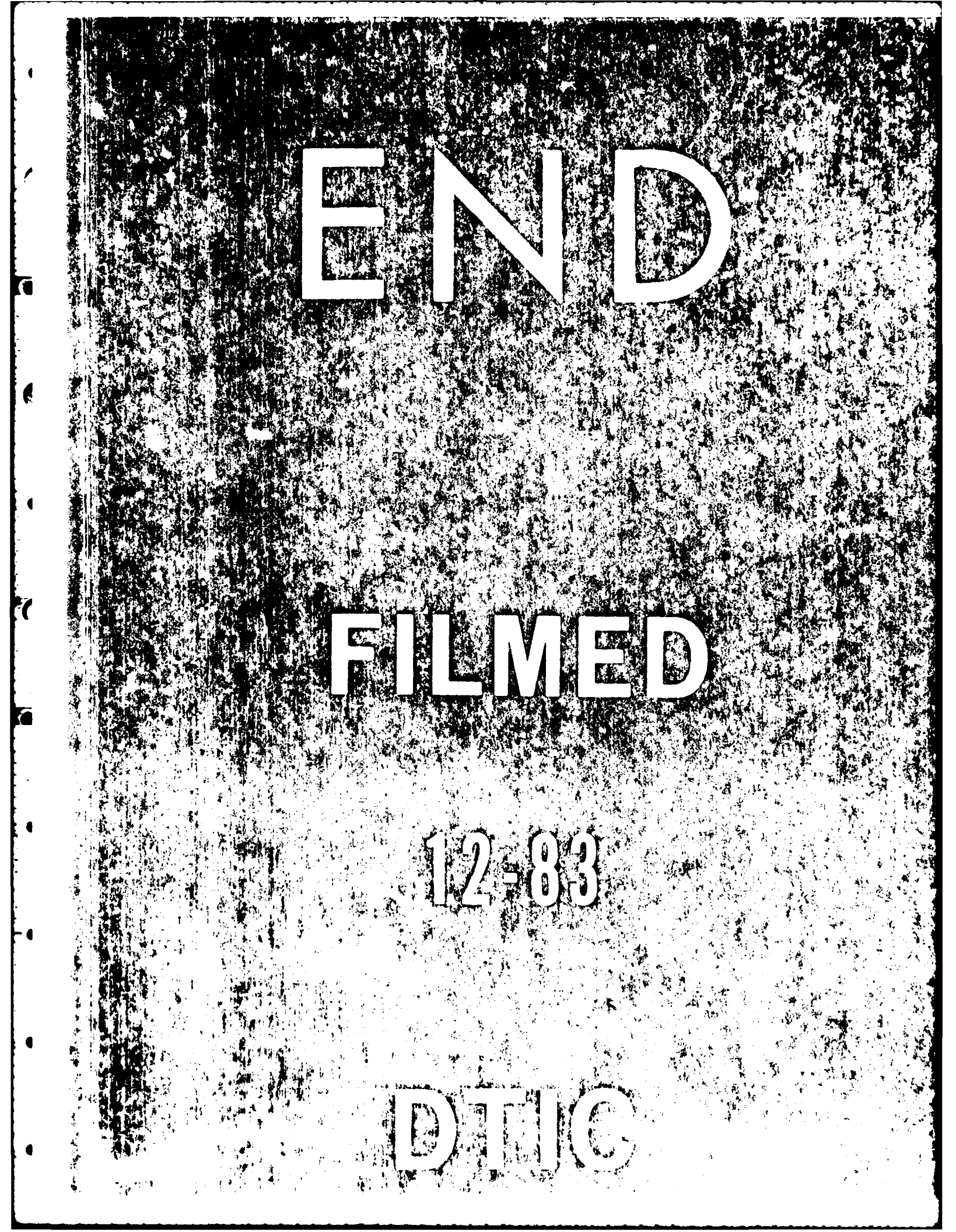
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